Deliverable D 26.1
Use Case Collection Process

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1. Executive Summary

The usage of latest digital technologies (e.g. federated data spaces, CDM, digital twins, etc.) are key enablers to drive the railway industry forward and are mainly responsible for almost any optimization within the last years. That is why FP1-MOTIONAL Work Stream 2 (Work packages 26-31) is focused on the investigation of new technologies as well as the adoption of existing ones that are available on the market to enable these for the railway community; so, called: “technical enablers”.

Since, this approach would remain ineffective until these technical enablers are not used in combination with a use case, WP26 is obliged to technically enable as many use cases as possible, that evolve from the other flagship projects. However, only those use cases shall be cooperated with, where’s use case owner are requesting for that sort of support. The usage of WP26 technical enablers is not mandatory to any use case owner.

Main goal of this first task within WP26 (26.1) was to come to a common understanding of how the required use cases that evolve from the other flagship projects shall be identified and interacted with. This interaction shall include the identification of use cases as mentioned above, that envisage the usage of at least one technical enabler technology developed in workstream 2 FP1-MOTIONAL. Furthermore, it shall set relevant stakeholders (namely use case owners and owners of technical enablers) into contact with each other to join forces within an iterative process, where the use cases and the technical enablers are combined step by step to research on it’s synergies and effectiveness (Task 26.2). Finally, the outcome of this investigation shall be to come to a consensus of how the set of use cases shall be collected and documented (Task 26.3).

For this purpose, the WP26 working group developed a process within task 26.1 on basis of the “swim lane” methodology that maps all stakeholders and their respective tasks within the use case collection process execution. The process description covers the identification of relevant use cases, the collection of them and - if applicable – their adoption by the System Pillar towards standardization.

This process as well as the common understanding are considered the main outcome of this task and are described in this document.

2. Abbreviations and acronyms

Abbreviation / Acronym	Description
CDM	Common data model
DoA	Description of Action
DT	Digital Twin
ERA	European Railway Association
EU-Rail JU	Europe's Rail Joint Undertaking
FDS	Federated data space
FP	Flagship Project
FP1-TT	Flagship project 1 (FP1-MOTIONAL) work packages 26 - 31
SGx	Sub group of FP1-MOTIONAL
STIP	Standardisation and TSI Input Plan
TE	Technical Enabler
TSI	Technical Specifications for Interoperability
TT	Traversal Topic
UC	Use Case
WP	Work Package
WSx	Work Stream of FP1-MOTIONAL

3. Background

Within the FP1-MOTIONAL project there are two work streams (WS) contributing to the project's overall success. Workstream 2 consisting out of the work packages 26 – 31 are considered the providers of technical enablers (TE). In an earlier stage of the project FP1-MOTIONAL WS2 this set of work packages was also considered to be named "Traversal Topic on digital enablers" (TT) as well it is called Subgroup 4 (SG4). Therefore WS2 / SG4 / TT may be considered synonyms. However, its tasks remain the same: To provide latest technologies such as digital twin (DT) technology or federated data spaces technology (FDS) and develop it further to enhance the rail industry.

The idea is to work on these technologies and boost railway related use cases that evolve everywhere in the EU-Rail JU program by offering these technologies to the use case owners to find out about its potential to enhance the respective use case.

This report covers the description of a process that shall allow doing the above.

4. Objective/Aim

The aim of task 26.1 and this Deliverable D26.1 is to describe the initial process to collect the digital artefacts produced by WS1 of FP1-MOTIONAL, FP2 to FP6 and FA7 [1]. As Use Cases are a very well-introduced concept to describe digital interaction, they are used as approach here [2, 3]Two main results are presented here: The initial process description and a Use Case template for the case that the providing project work package or workstream has no own template containing the required information.

5. Use Case collection (capture) process

The development of the process took place in multiple common meetings, where all WP members raised their voice and provided input to the process description. The methodology used is based on the swim lane process description framework also known as the process flow diagram.

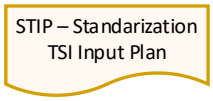
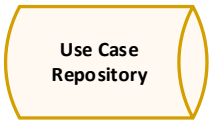
5.1. Process description

The process itself is described in three phases:

1. The left-hand side of the diagram covers the identification of relevant UC by **WP26** and their respective UC owners and filling the repository but not reviewed, selected or prioritized.
2. The middle part describes the collaborative interaction in between the UC owners and **WP27 – WP31**, the owners of the TE within FP1-MOTIONAL Subgroup 2, who select the best suited use cases for their TE. Here we hope to make mutual benefit from each other, where TE can positively influence the development of a use case.
3. The right-handed side of the diagram includes the optional part of some TE enabled UC might be candidates for standardization and hence to be mentioned in the STIP. Those candidates are discussed with the **System Pillar** as decision making entity if a standardisation process is initiated. Such a process will then be in the hands of the System Pillar and out of scope of WP26.

Legend

	Process beginning and ending
	This icon is used to describe a task / working step that shall be executed by the respective entities (might by multiple ones or single)
	Symbol to describe that a decision is required before continuation. Usually this shall be YES/NO but can also have a more complex outcome

	Symbol to inform, that there is a specific document to be updated/contributed to or being used to fulfil or support a task / working step. This document is relevant for the task at hand.
	Icon to display a database / data collection entity that collects, stores and provides information.
	Supporting flow from one entity to another. Can be the flow of information or the support of some entity to another on a task
	Diagram flow. Displays the main flow direction and the consecutiveness of working steps.

Description of entities

TT representative	Work package 26 – 31 member. WP26 for the initial collection of use cases, WP27 – WP31 for the subsequent collaborative detailing
Use case owner	The person responsible for the use case that shall be upgraded or supported by at least one technical enabler (TE) such as federated dataspaces, CDM, Digital Twin, etc. developed in FP1-MOTIONAL WS2
FP Leaders	Flagship project leaders, that shall be asked/interviewed towards potential use cases within their respective flagship project to ensure proper capturing of all relevant use cases
System Pillar representative	The System Pillar is important in this process if the results are considered candidates for standardization. If so (decision required) the System Pillar shall name individuals to drive the standardization process
TE Owners	The owner and/or developer of a specific technical enabler (TE) such as federated dataspaces, CDM, Digital Twin, etc. developed in FP1-MOTIONAL WS2
Standardization body / ERA/ etc.	Depending on the specific nature of the standardization object (use case that is improved by at least on technical enabler), different standardization entities (such as ERA or others) might be addressed to drive the standardization. The System Pillar shall be in charge of the selection of a proper standardization body.

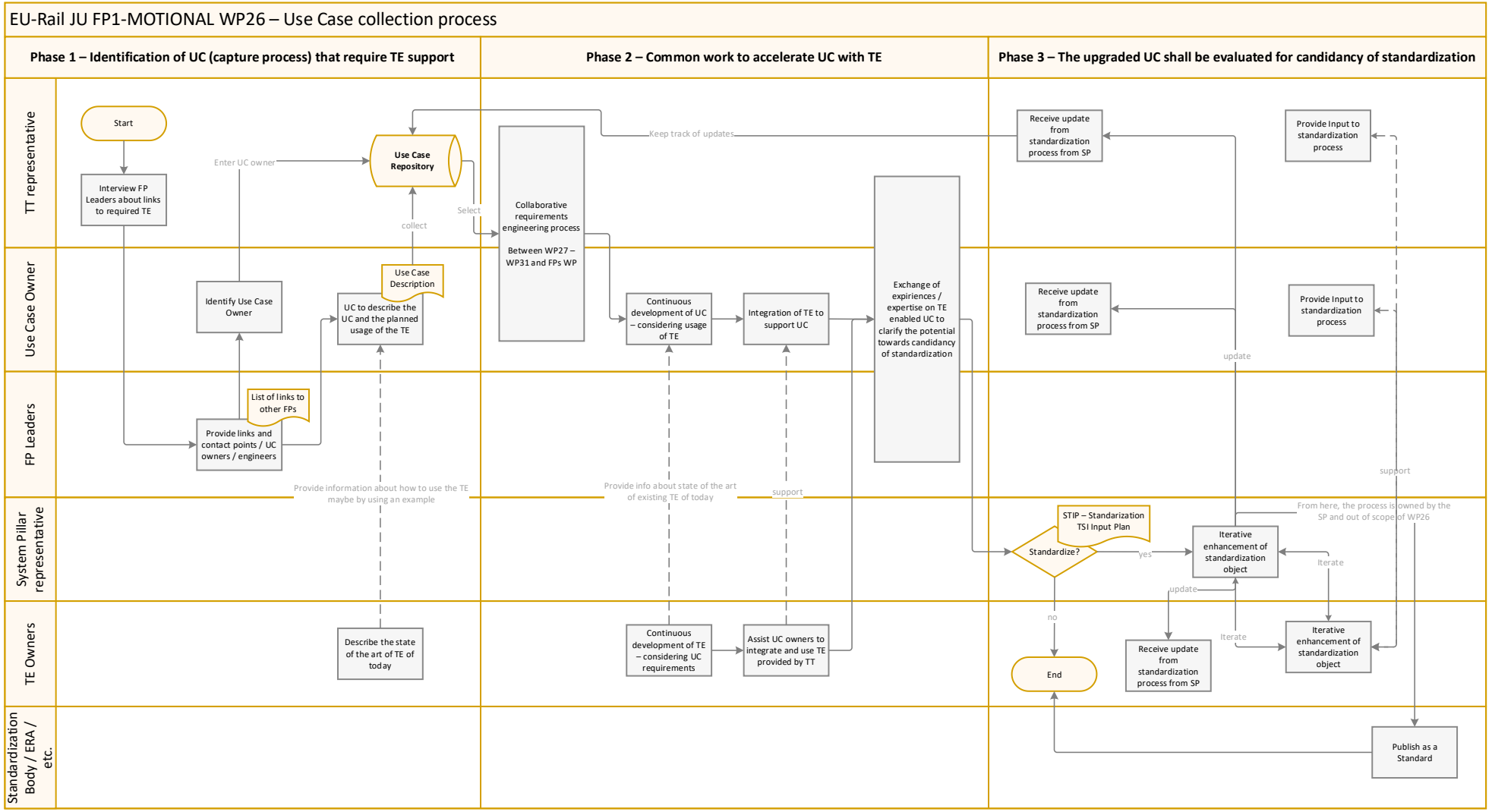


Figure 1: Use Case Collection Process Flow Diagram

5.2. Use case collection template

Phase 1 describes the identification and collection of use cases as well as some details about the use case itself, rough explanation of the technical details and requirements. The following template was proposed to collect this information, if no other template is used already by the FP. In practical terms, WP26 is analysing Use Case collection Deliverables by the FP if they exist. In some cases, it might be meaningful to not use all of the items and maybe add some others. It depends on the use cases nature to figure out an optimal fit.

However, this template grants enough freedom to anticipate the requirements of the use cases to be flexible enough. At the same time, it shall help to harmonize the inputs received from the other destination to facilitate further consultation with FP1-MOTIONAL, as it is requested in the DoA.

Table 1: Use Case Template

Name	Descriptive name of the Use Case
ID	ID of the Use Case "UC-FP1-WPx-number"
Description	Short description of the Use Case
Related to task / subtask(s)	Precise task/subtask that this use Case relates to (specification/implementation/demonstration)
Impact on other task(s)	Indicate the tasks that may depend on the result of this Use Case (dependencies identification)
Technical Enabler	Indicate TE involved "No. & Name"
Interactions SP/FP	Indicate when applicable the interaction between SP and other FP
Actor(s)	Involved Actors
Trigger	Action or event that triggers the Use Case
Pre-Condition(s)	What is the state of the system, which allows to perform the use case
Initial Input	Required input to execute the use case
Result/Requirement	What will be the expected result of the use case
Final state	If applicable, describe the expected finale state of the system after the use case was performed
Sequence	List the steps of the use case (to be filled during specification phase) 1. 2. 3.

Expected Implementation / Release Date	Date when the UC is expected to be ready for tests (Monthly/Year)
Involved components (Systems level)	List of software/hardware components that will be involved to run the UC (to be filled during the specification phase)
Responsible partner / person (Use Case Owner)	Company or main contact who is responsible to describe this Use Case and guarantee the system design and implementation
Link to detailed document	Unique identifier of Document (e.g. Deliverable Dx.y of FPz) best case with version and chapter
Notes	Additional notes of the UC

5.3. First examples

By the time this report was created, WP27 already started the collection of use cases using this template. Some examples are attached to report within the appendix section to give some additional guidance to the usage of this methodology.

6. Interactions with other flagship projects

WP26 is by default the main driver of the interaction between FP1-MOTIONAL WS2 and the other flagship projects. Since the WP26 members as well as the FP1-MOTIONAL WS2members are obliged to reach out to all other destinations within the EU-Rail JU programme by the means of phase 1 of the process described in this deliverable, it shall be seen as the main interaction body of FP1-MOTIONAL WS2.

However, all members and partners of FP1-MOTIONAL WS2 will reach out to the other destinations in parallel. WP26 shall only document and collect the interactions for later documentation. A first overview of touchpoints can be found at ref [1].

It is not within the scope of WP26 to participate in all of these discussions in detail, since that workload would overwhelm and turn out to be not effective.

7. Conclusions

The successful establishment of a common understanding within the WP will lead to a very good process execution in terms of collection of Use Cases from the other flagship projects.

By now, the execution of phase 2 has already started. WP26 is therefore entering Task 26.2.

8. References

[1] FP1-MOTIONAL: Description of Action. December 2022

[2] Kurt Bittner, Ian Spence: Use Case Modeling. Addison-Wesley Pearson Education, Boston 2003, ISBN 0-201-70913-9.

[3] Daryl Kulak, Eamonn Guiney: Use cases: requirements in context. 2. Edition. ACM Press, New York 2004, ISBN 0-201-65767-8.

9. Appendices

Example use case collection from WP27 using WP26 methodology (incl. process and template)

Table 2: WP27 Example Use Case 1

Section	Description
Name	TCCS SD1 Data Model
Current Situation	Today, several standards provide interface data formats, such as EULYNX Data Prep, railML, RSM, RCA, IFC-rail, Linx4Rail, and X2R4. These partially overlapping standards complicate the decision process of Infrastructure Managers or other parties to invest and build toolchains following long-term road maps. Also, the coexistence of several data standards in parallel for the same use case is not acceptable for safety, functional or economic reasons if a new, standardized architecture, as intended by the System Pillar, is developed.
Objects Involved	Current version of SD1 Data Model is focused on CCS/TMS-related use cases and systems. Key entities managed include: • Track edges and links • Track alignment in terms of horizontal and vertical curves • Cant values The entities will be extended with new object types in the new versions.
Main Actors Involved	• Contractors involved in ATO, Traffic Management Systems, Train Protection, Localization, Diagnostic Systems, etc. • Infrastructure Managers having the responsibility to provide to the various actors of the supply chain, an access to the single source of truth.
Challenge	As with national BIM plans by infrastructure managers, a proper digitisation strategy also relies on the standardisation of interfaces within this process to support coordination, data exchange, and close collaboration within the project. The data structures developed in national contexts are a first step towards this digitised process flow. The international standardisation of data formats, rules, and processes improves the business case and ROI due to scale. Higher development costs related to safety, such as CCS, increase the need for a standardised environment with the semi-automated, digitised engineering process, i.e. planning, validation or transformation functions.
Risks	• No input or low buy-in from all stakeholders involved with data consumption for using a standard data model • Issues when data being brought into the systems isn't in a format and quality usable by data consumers. • Complex data transformation required to access to common data

Section	Description
Opportunity	• EU-Rail JU System Pillar shall improve the situation by harmonising the input information required from engineering or infrastructure data inputs to operate the System Pillar systems within their area of operation. • Picking and recombining fragments from existing data models to fit the requirements of multiple data users. • Direct using the data models by the systems without complex transformation. • Support the migration to the "Single European Railway Area" (SERA) with specific extensions of the model data interfaces

Table 3: WP27 Example Use Case 2

Section	Description
Name	Common Infrastructure Data for Infrastructure Condition Monitoring
Current Situation	Diagnostic services use a set of trains and vehicles, equipped with diagnostic systems, to inspect and measure the railway infrastructure. The systems collect condition data used by the Infrastructure Manager for identifying safety related defects and planning the maintenance & renewal intervention. Any diagnostic system requires some infrastructure data to process the condition data collected. Such infrastructure data belong to four main classes, namely: • **Railway Network**: track name, start location and end location, etc. • **Track Layout**: curve locations, start location of the curve, curve radius, etc. • **Assets:** switches, level crossing, bridges, poles, etc. • **Operational Data:** maximum speed of the tracks, etc. Some data (e.g. track references) are used to reference the collect data on the track model, other data are required for identification of the defects (e.g. track geometry system requires track speed for the calculation of defect thresholds).
Objects Involved	• Track • Switches & Crossings • Track Speeds • Structures (bridges, tunnels, under-passings, etc.) • Horizonal alignment (with the indication of transitions, radius and cant)
Main Actors Involved	• **Infrastructure Manager** in charge to provide the infrastructure data required (at configuration time and at any update of the data for the entire duration of the service). • **Diagnostic Service Contractor** that takes the data provided by the Infrastructure Manager and loads them in the format required by the diagnostic system.

Section	Description
	• **Software Service Provider** that supports the conversion (**Extraction, Transformation and Load**) of the data provided by the Asset Data Manager and the format required by the Diagnostic Service Operator
Challenge	With the increase of the number of measuring systems in production at the Infrastructure Manager, the number of data exchanges has increased. Without a standard reference for the exchange of such data, Infrastructure Manager and Contractors must foresee custom data interfaces that leads to the railway industry adopting multiple data interfaces one for each actor involved in the use of the system. *In some cases, even if there is a single data interface, some data are still in a format not readable by a machine and requires manual work by the operator.*
Risks	The lack of a standard data interface can lead to the following: • **Higher cost** to develop and maintain multiple custom data interface to exchange the same data types • **Higher cost** for updating the same data in different systems • **Extra time** within projects to get access and use the data • **Overall reduced data quality** assuming that the more a single data source is used also efficiency and efficacy of data auditing increases.
Opportunity	With the adoption of a common data model, a reference data format can be defined and used across the supply chain without requiring custom solutions.

Table 4: WP27 Example Use Case 3

Section	Response
Name	Harmonized Digital Engineering Process and Data Exchange
Current Situation	The current engineering process of ERTMS-Interlocking across Europe is at different level of digitization. In addition, the process of engineering is very diverse which contradicts the idea of SERA and European Railway Traffic Management system. The goal of this use case is to harmonize the processes according to the target system architecture. This involves harmonizing data requirements as well as information exchange format.
Objects Involved	Objects which are required for ETCS L2 planning such as: 1. Track 2. End of track 3. Track Layout (straight, curve or transition curve) 4. Point 5. Crossing 6. Derailer 7. Level Crossing 8. Landmark 9. Speed restriction signs 10. Movement permission target marker

Section	Response
	11. Stop location sign 12. Light signals 13. ETCS Marker 14. Balise 15. Balise group 16. Tunnels 17. Bridges and culverts 18. Station platforms 19. Mileage change 20. Track Bed 21. Train detection units 22. PZB/Indusi[1] 23. Fouling point marker (Danger Point for safety) 24. ETCS-Level 25. Underpasses 26. Track junction[2]
Actors Involved	1. Requirements provider based on their use cases. 2. Actors responsible for rail lines operation and maintenance. 3. Modelers to ensure the correct integration of different requirements into a comprehensive model that can serve all needs. 4. Software entities that provide computational tools and digitize the engineering process. 5. Signalling suppliers. 6. Signal engineers/designers. 7. Infrastructure managers. 8. Signalling Project managers.
Challenge	1. Change in the naming convention and/or semantics across different requirements providers. 2. Developing modelled entities that can express the requirements. 3. Integrating all process components from end to end.
Risks	• Diverging process which leads to increase in cost and loss of interoperability. • Vendor locking and monopoly.
Opportunity	• Foster innovation by reducing market entry barrier. • Reduce cost and delivery time thanks to interoperability.

[1] This object is known as Class B systems in Signalling. They are magnet that is activated to stop a train in case of malfunction. They are usually attached to the track.
[2] This is not an object but the information required about the level of ERTMS (Level 2 or HL3).